

## **Metro West SWM / BMP / LID Maintenance Guidance / Criteria**

### **I. Introduction**

The purpose of this guidance is to ensure the proper long term operation, function and maintenance of the stormwater management (SWM) best management practices (BMP's) and low impact development practices (LIDs). This guidance is of particular importance for the innovative LIDs to ensure property owners and property managers are fully aware of how to provide proper maintenance. This stormwater management maintenance criteria and guidance and in lieu of the related requirements of the Public Facilities Manual ("PFM") for (SWM), best (BMPs) and innovative low (LIDs).

### **II. General**

- a. Perpetual maintenance of SWM/ BMPs and LIDs will be the obligation of the Applicant and will transfer to the Home Owner Association (HOA) / property owners / property managers as appropriate. The applicant will provide maintenance guidance for all BMPs / LIDs to be used by property managers and landscape contractors to ensure proper long term function and aesthetic value of the SWM measures.
- b. Funding of maintenance activities is the responsibility of the applicant and will transfer to the HOA / property owner / property manager as appropriate. The HOA covenants will provide authority to assess SWM maintenance fees on all property owners or / HOA members in the appropriate amount to ensure adequate funding of all SWM BMPs / LIDs for maintenance in accordance with guidance provided here within.
- c. The applicant / HOA / property owners will submit an annual maintenance report to DPWES describing all inspection and maintenance activities and / or deficiencies and certify that all SWM BMP / LIDs have been maintained in accordance with the guidance here within. The annual report should include the names, addresses, telephone numbers of the current owner(s) and the individual(s) responsible for maintenance of the BMPs / LIDs. The inspection maintenance reports will be kept on file by the HOA / owner / operator and made available for inspection by County officials.

- d. The HOA agreement will enable the County's to inspect all SWM / BMPs / LIDs, review / approve the annual maintenance reports and provide the County the ability to place liens on property to ensure proper maintenance of all SWM / BMPs / LIDs.
- e. In addition to the guidance provided here within the HOA / property owners / property managers and maintenance contractors should follow all manufacturers' guidance related design, construction, activation, operation and maintenance for all SWM / BMPs / LIDs.

## **Detention Vault**

**Description:** Detention vaults are designed to fill with stormwater during large storm events and slowly releasing it over a number of hours. Detention vaults provide channel protection and overbank flooding for the 1, 5, and 10 year design storms. Vaults are not intended for water quality treatment and must be used in a treatment train approach with other controls to obtain water quality objectives.

There are numerous components to detention vaults. Drain inlet pipes convey stormwater into the detention storage vault. The vault structure stores and accumulates runoff during a storm event. The vault outlet orifice structure to the drain pipe restricts the flow out of the vault allowing it to fill up and slowly drain out. The orifice structure is located at the downstream end of the detention vault chamber.

**Inspection / Maintenance Guidance:** Access to the detention facility is required for efficient maintenance. Egress and ingress routes must be provided and maintained to design standards. Vaults should be inspected quarterly and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. Training and/or written guidance information for operating and maintaining the vaults shall be provided to all property owners and managers.

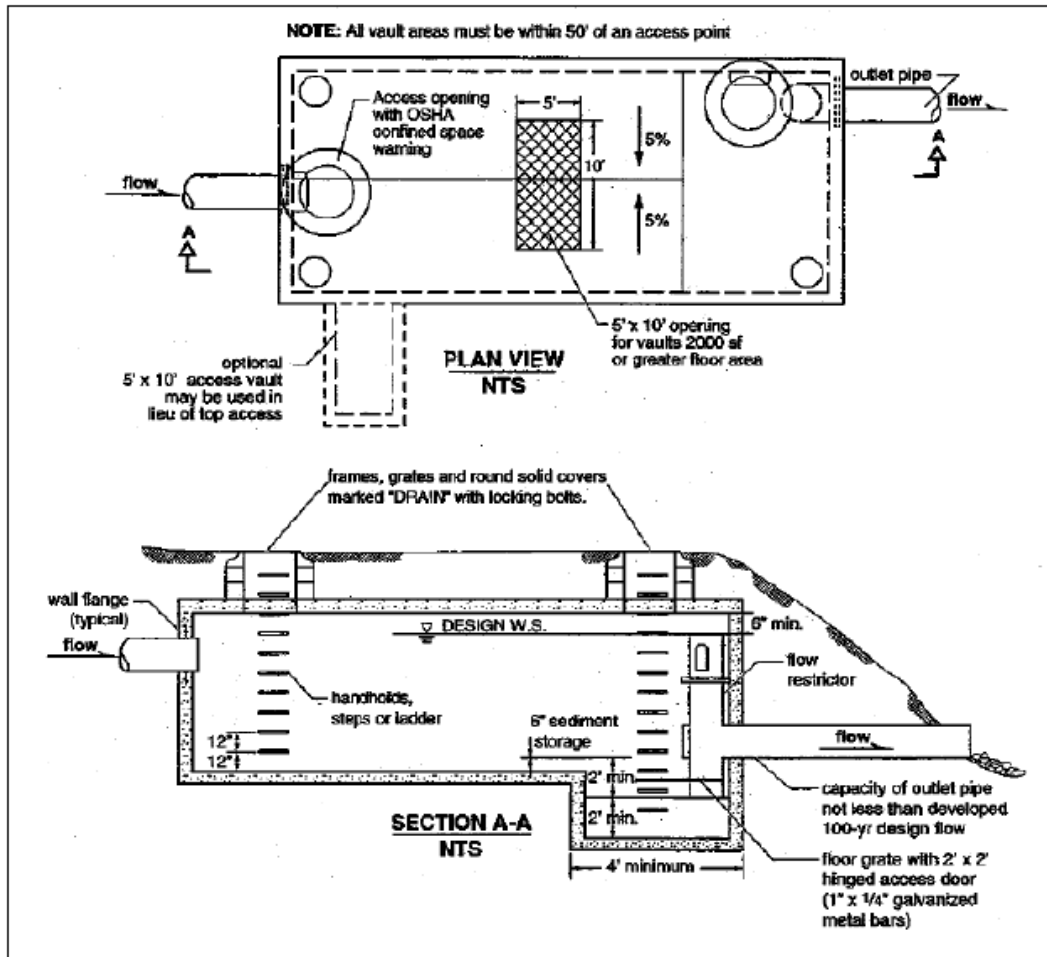
Signage may serve to educate people about the importance, function and operation of the vault. Signs may also discourage behavior that may adversely impacts the vault operation and encourage behavior that enhances or preserves the facilities functions. For example, if trash and debris is a problem, a sign reminding people not to litter may partially solve the problem. Signage (where applicable) will be maintained and repaired as needed.

The following items shall be inspected and maintained as stated:

- Drain inlet pipes should be inspected for clogging or leaks where it enters the vault during every inspection and cleanout.
- Debris / sediment that is found to clog the inlet shall be removed, tested, and disposed of in accordance with applicable federal and state requirements.

- The vault chamber should be inspected for cracks or damage during each inspection.
- The vault chamber should be cleaned out yearly or after an inch of sediment has accumulated. If there is a valve on the outlet pipe it shall be closed otherwise the outlet shall be plugged prior to cleanout. Grit and sediment that has settled to the bottom of the chamber shall be removed during each cleaning.
- Water and sediment in the detention chamber shall be removed, tested, and disposed of in accordance with regulations.
- Cleaning shall be done without use of detergents or surfactants. A pressure washer may be used if necessary.
- Orifice structure/ outlet drain pipe shall be inspected for clogging during unit inspections/cleanouts.
- Debris/sediment that is found to clog the inlet shall be removed, tested, and disposed of in accordance with applicable federal and state requirements.
- Perform structural repairs to the vault, inlet structures and outlet structures as needed based in inspection.
- Source control measures such as street sweeping and other good house keeping practices should be employed to prevent trash, debris and sediment from entering the vault. .

## Typical Schematic of Detention Vault



## **Bioretention Cells**

**Description:** Bioretention cells are shallow depressed landscaped areas that are designed to accept and manage stormwater runoff to improve both water quality and quantity. Water quality is provided through a variety of physical, chemical and biological process within the plant / microbe / soil complex. Water quantity controls are provided within the upper shallow depression storage area and the void spaces within the soil media. Volume is control through detention, infiltration and evapotranspiration. These facilities normally consist of a shallow ponding area, vegetation (turf, shrubs, and trees) and engineered filter media and an underdrain system (dewatered by a drain pipe or infiltration).

**Inspection / Maintenance Guidance:** Bioretention cells are operated and maintained in the same manner as any typical landscape area. However, proper operation and maintenance is critical as these facilities are vital to water quality protection. Normal landscape care is typically all that is needed to maintain the health of the plants and its water quality function. Irrigation is recommended in the same manner as with other landscaping. If routine irrigation is necessary or desired for conventional landscaping then the bioretention cells should be irrigated too. Irrigation will generally be needed during extended droughts.

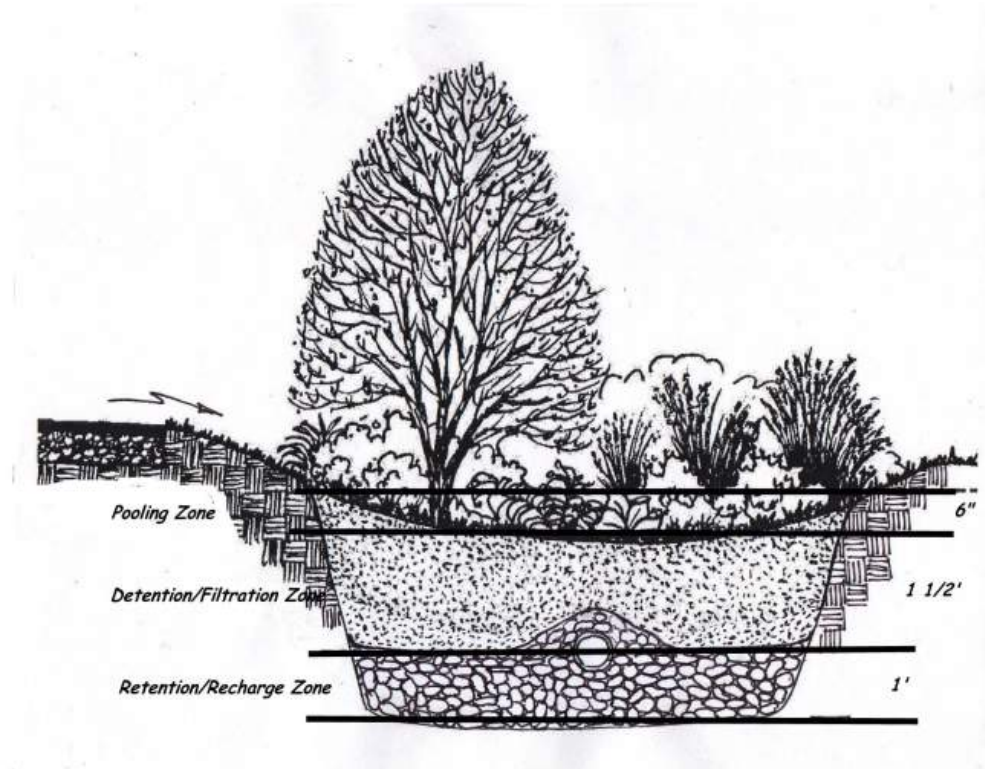
The bioretention cells should drain within 24 hours after a storm event, All facility components and vegetation should be inspected for proper operations and structural stability. These inspections should occur, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities.

The following items shall be inspected and maintained as stated:

- Particular attention should be given to where the runoff enters the bioretention cell to ensure runoff enters the facility in a nonerosive manner predominantly by sheet flow and not restricted in any manner.
- Sources of erosion damage should be identified and controlled when native soil is exposed or erosion channels are forming.
- Sediment build-up near or exceeding 4" in depth shall be removed. Sediment accumulation should be hand-removed with minimum damage to vegetation using proper erosion control measures.
- Where applicable mulch should be removed or replaced on an annual basis

- If the bioretention cell does not drain within 48 hours, it shall be regraded and replanted according to design specifications.
- Debris in quantities more than 2" deep or sufficient to inhibit operation shall be removed routinely (e.g., no less than quarterly), or upon discovery.
- Where applicable underdrains should be inspected and unclogged as needed.
- Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Fallen leaves and debris from deciduous plant foliage shall be raked and removed as needed. Nuisance and prohibited vegetation shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced. Dead vegetation shall be removed to maintain less than 10% of area coverage or when vegetative filter function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.
- Egress and ingress routes shall be maintained to design standards.
- Insects and rodents shall not be harbored in the facility. Pest control measures shall be taken when insects/rodents are found to be present. If sprays are considered, then a mosquito larvicide, such as *Bacillus thurendensis* or Altoside formulations can be applied only if absolutely necessary, and only by a licensed individual or contractor.
- In the event of major contamination such as oils, chemicals, toxic spills, etc, the contaminated media should be removed, properly disposed of, replaced with new media and a plant.

## Typical Bioretention Cell





## **Tree Box Filter Maintenance Criteria**

**Description:** Tree box filters are based on bioretention technology where stormwater runoff filters through a plant / soil / microbe media to capture, remove, and cycle pollutants through a variety of physical, chemical, and biological processes. Stormwater runoff drains directly from impervious surfaces through an inlet structure in the concrete box and flows through the mulch, plant, and soil filter media. Treated water flows out of the system via an under-drain connected to a storm drain pipe or other appropriate outfall. The system consists of a concrete container, a 3 inch mulch layer, 1.5 to 3.5 feet of an engineered soil filter media, an observation / cleanout pipe, an under-drain system and an appropriate type of plant such as a shrub or small tree.

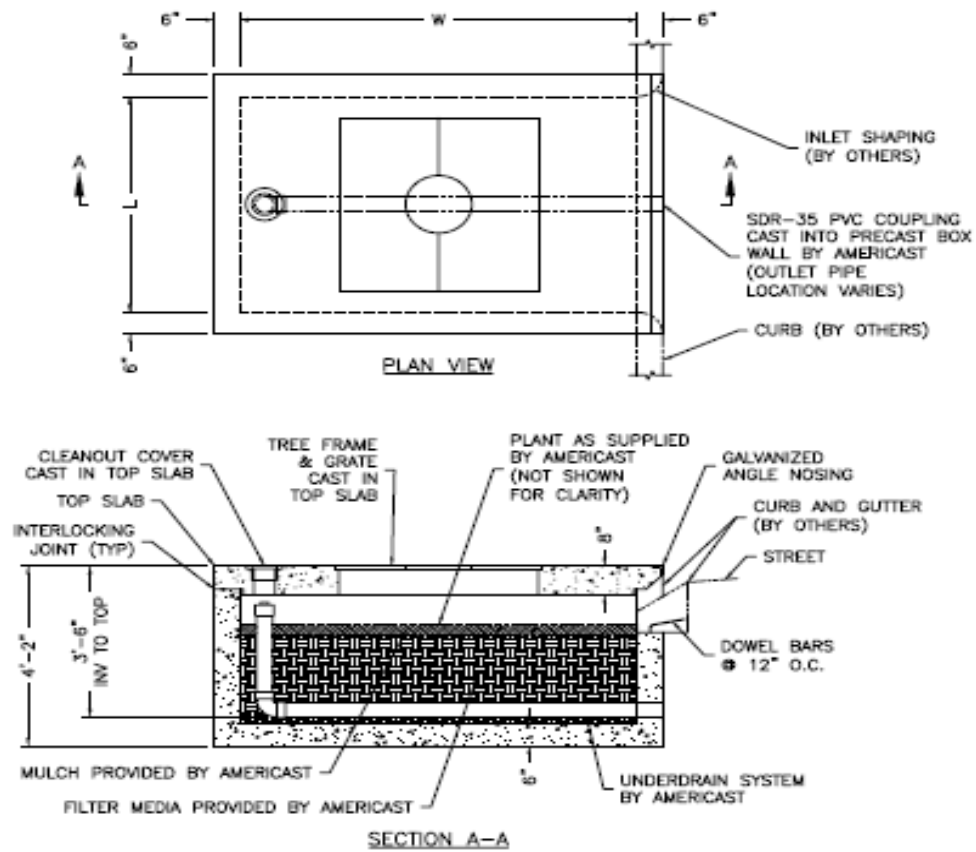
**Inspection / Maintenance Guidance:** Water should drain through the filter box within 1/2 hour after a storm event. All facility components and vegetation should be inspected for proper operations and structural stability. These inspections should occur, at a minimum, quarterly for the first 1 year from the date of installation and 2 times per year thereafter. Maintenance visits should occur seasonally; the spring visit to clean up after winter loads of abrasives used for ice and snow. The fall visit to clean the system by removing excessive leaf litter, trash and debris. If there are high trash loads inspection and cleaning should occur more frequently. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities.

The following items shall be inspected and maintained as stated:

- The system should not be placed in operation until the site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed).
- Litter and debris shall be removed routinely (e.g., no less than quarterly) and upon discovery.
- Structural deficiencies in the planter including rot, cracks, and failure shall be repaired.
- If water does not drain from reservoir within ½ hour of storm event, sources of clogging shall be identified and corrected. If the media needs to be replaced it must be replaced with the same materials recommended and specified by the County and / or the manufacturer

- Mulch shall be replenished at least annually.
- Planter vegetation shall be irrigated to ensure survival.
- No fertilizer is recommend.
- Use typical care and maintenance of plants i.e. prune and replace as necessary in accordance with the condition and type of plant used.
- Nuisance vegetation should be removed when discovered.
- Dead vegetation shall be removed and replaced immediately.
- Training and/or written guidance information for operating and maintaining planters shall be provided to all property owners and tenants.
- Insects and rodents shall not be harbored at the stormwater planter. Pest control measures shall be taken when insects/rodents are found to be present.
- In the event of major contamination such as oils, chemicals, toxic spills, etc, the contaminated media should be removed, properly disposed of, replaced with new media and a plant.
- Where applicable follow other operation and maintenance guidance as recommended and specified by filter box manufacturer the manufacture

## Typical Tree Box Filter



## **Modular Permeable Pavers**

**Description:** Modular permeable pavers are structural units, such as concrete blocks or bricks with regularly interdispersed void areas used to create a load-bearing pavement surface. The void areas are filled with pervious materials (gravel or sand) to create a system that allows for the infiltration of stormwater runoff into the underlying gravel base / soils. Permeable paver systems provide water quality benefits in addition to groundwater recharge and reduction in stormwater volume. There are many different types of modular pavers available from different manufacturers, including both pre-cast and mold in-place concrete blocks, concrete grids and interlocking bricks.

Permeable pavers are typically placed on a gravel (stone aggregate) base course. Runoff infiltrates through the porous paver surface into the gravel base course, which acts as a storage reservoir as it exfiltrates to the underlying soil. An underdrain system of the infiltration rate of the soils in the subgrade must be adequate to support drawdown of the entire runoff capture volume within 48 to 72 hours. Special care must be taken during construction to avoid undue compaction of the underlying soils, which could affect the soils' infiltration capability.

Modular permeable paver systems are typically used in low-traffic areas such as parking pads in parking lots, residential driveways, residential street parking lanes, recreational trails / paths and emergency vehicle and fire access lanes.

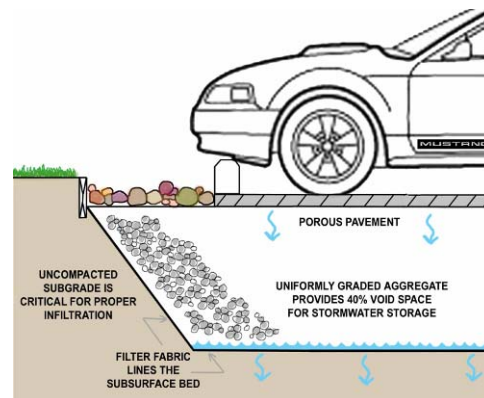
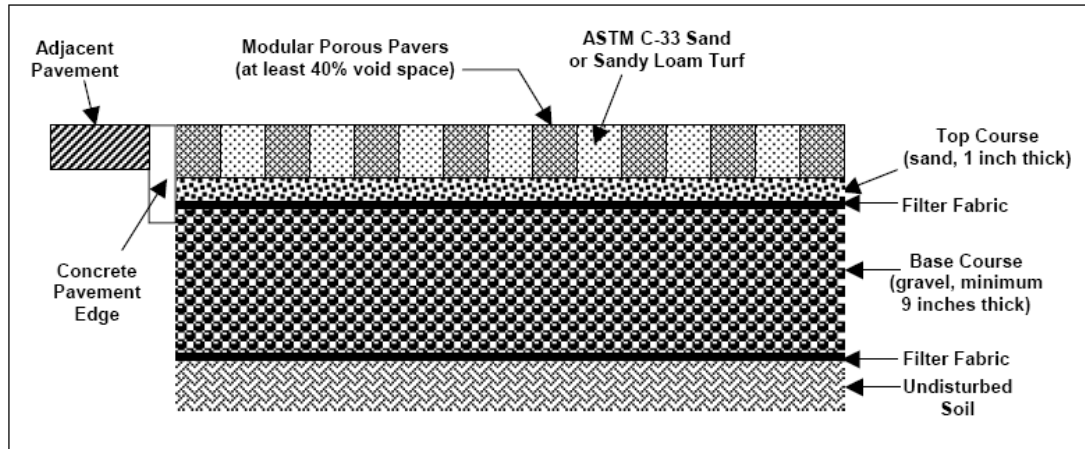
**Inspection / Maintenance Guidance:** The paver must remain permeable to allow surface water to enter into the underlying stone reservoir that temporarily stores surface runoff before infiltrating into the subsoil or being collected in underlying drain pipes and being discharged off-site. All facility components and source controls shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities.

The following items shall be inspected and maintained as stated:

- In most pervious pavement design, the pavement itself acts as pretreatment to the stone reservoir below. The surface shall be kept clean and free of leaves, debris, and sediment. The surface shall not be overlaid with an impermeable paving surface or sealing compounds materials.
- Check monthly to make sure that the system dewater between storms (less than 1 hour to dewater).

- Inspect the surface for deterioration annually
- Regular vacuum sweeping or high pressure hosing on a quarterly basis to remove sediments.
- Sources of erosion that may carry sediment to the permeable pavers shall be identified and controlled when native soil is exposed near the overflow structure. Ensure that the contributing and adjacent area is stabilized and mowed, with clippings removed.
- Salts and sands should be used sparingly, if at all, for deicing in the winter. A snowplow may be used to clear the surface. The blade does not need to be lifted.
- Spill prevention measures should be exercised to reduce the likelihood of the accidental discharge of toxic substances onto the permeable pavers. It is important to notify property owners and tenants about the importance of the proper use, disposal and recycling of all household chemicals, antifreeze, oil, solvents and cleaning aids to reduce spills or improper discharges onto the permeable pavers. Signage may serve to educate people about the importance and function of the site's stormwater protection measures and their role in its long term care. Signage may also discourage behaviors that adversely affect stormwater protection measures.
- Any settling or cracked blocks should be reset and recompactd per the manufacturer's recommendations.
- Totally rehabilitate the paver system, including the top and base course, as needed or upon failure.

## Typical Permeable Pavers



## **Green Roofs**

**Description:** Green roofs are vegetated roofs that retain and filter stormwater and provide aesthetic and energy conservation benefits. Green roofs help replace the vegetated footprint that was destroyed when the building was constructed. Green roofs can be categorized as 'intensive' or 'extensive' systems depending on the plant material and planned usage for the roof area. Intensive green roofs use a wide variety of plant species that may include trees, shrubs and flowers and may require deeper substrate layers. They are generally limited to flat roofs and require 'intense' maintenance, such as pruning and irrigation. Intensive green roofs are often park-like areas accessible to the general public. In contrast, extensive roofs are limited to herbs, grasses, mosses, and drought tolerant succulents such as Sedum. Extensive green roofs require much less substrate and can be sustained in a layer as shallow as 2.0 cm, or 1.5 in. They require minimal maintenance, and are generally not accessible to the public.

**Inspection / Maintenance Guidance:** Green roofs must be maintained, like any garden. Pruning, weeding and perhaps watering will all be necessary. Maintenance depends largely on the type of system in place. Initial watering and occasional fertilization are required until the plants have fully established themselves. Supplemental irrigation in addition to natural precipitation at least once a week may be required in the first six months or so depending upon the type of roof membrane and water requirements of the planting material. Extensive green roofs sometimes rely on a permanent drip tubing system which directly targets the root zone, and that can be put in place during the green roof installation process. Once the plants are healthy and well established extensive green roofs no longer need to be irrigated except in cases of extreme drought. Plants for green rooftops must be selected with care if the roof is expected to stay more or less maintenance free.

All facility components, including soil substrate or growth medium, vegetation, drains, irrigation systems (if applicable), membranes, and roof structure shall be inspected for proper operations, integrity of the waterproofing, and structural stability throughout the life of the facility. All elements shall be inspected quarterly. An intensive system will require more maintenance than an extensive system because intensive systems are much more complex. Drains and gutters, in both systems, will need more maintenance because of the added plant material on the roof. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities.

The following items shall be inspected and maintained as stated:

- Soil substrate / growing medium shall be inspected for evidence of

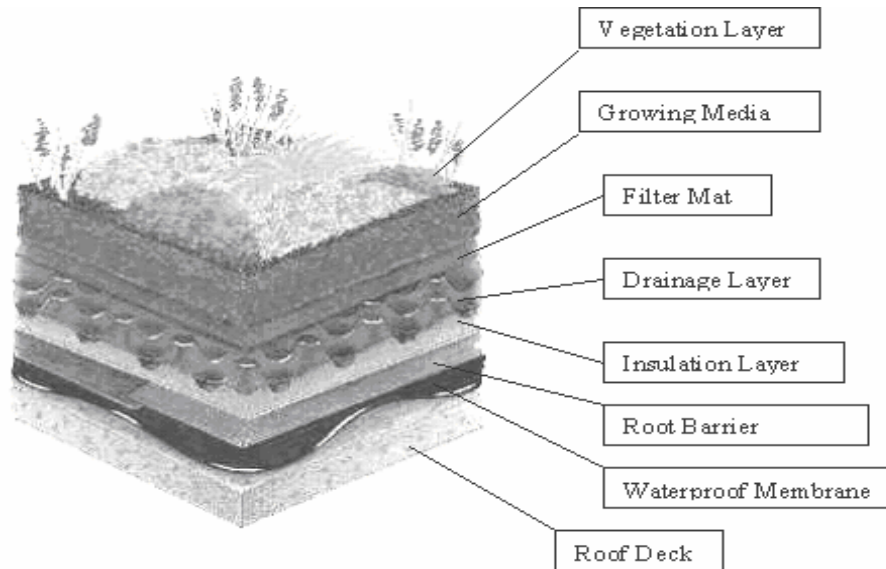
erosion from wind or water.

- If erosion channels are evident, they shall be stabilized with additional soil substrate/growth medium and covered with additional plants.
- Structural components shall be operated and maintained in accordance with manufacturer's requirements. Drain Inlets shall be kept unrestricted.
- Inlet pipes shall be cleared when soil substrate, vegetation, debris or other materials clog the drain inlet. Sources of sediment and debris shall be identified and corrected.
- Vegetation shall be maintained to provide 90% plant cover.
- During the establishment period, plants shall be replaced once per month as needed. During the long-term period, dead plants shall generally be replaced once per year in the fall months.
- Fallen leaves and debris from deciduous plant foliage shall be removed.
- Nuisance plants shall be removed when discovered.
- Dead vegetation shall be removed and replaced with new plants.
- Weeding shall be manual with no herbicides or pesticides used. Weeds shall be removed regularly and not allowed to accumulate.
- Fertilization is not necessary and fertilizers shall not be applied.
- During drought conditions, mulch or shade cloth may be applied to prevent excess solar damage and water loss.
- Mowing of grasses shall occur as needed. Clippings shall be removed.
- Irrigation can be accomplished either through hand watering or automatic sprinkler systems. If automatic sprinklers are used, manufacturers' instructions for operations and maintenance shall be followed.
- During the establishment period, water sufficient to assure plant establishment and not to exceed ¼ inch of water once every 3 days shall be applied.



- During the long-term period (3+ years), water sufficient to maintain plant cover and not to exceed ¼ inch of water once every 14 days shall be applied.
- Spill prevention measures from mechanical systems located on roofs shall be exercised when handling substances that can contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.
- Access and safety to the green roof shall be safe and efficient. Walkways shall be clear of obstructions and maintained to design standards.
- Aesthetics shall be maintained as an asset to the property owner and community.
- Evidence of damage or vandalism shall be repaired and accumulation of trash or debris shall be removed upon discovery.

## Typical Green Roof



**Intensive Public and More Plant Variety.**

**Extensive No Public Use Less Maintenance**

